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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Hiroyuki Sato

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10/19/2009

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EXAMINER

LOEWE, ROBERT S

ART UNIT

PAPER NUMBER

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/540,833	<b>Applicant(s)</b> SATO ET AL.	
	<b>Examiner</b> ROBERT LOEWE	<b>Art Unit</b> 1796	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 17 August 2009.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 5,7,10-13,17 and 18 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 5,7,10-13,17 and 18 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                     | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## DETAILED ACTION

### *Response to Arguments*

Applicants argue that Miyahara et al. does not teach the newly added limitation that the discharge of hydrogen sulfide to the exterior of the system is directly linked with a weight loss of sulfur amount in the system. In other words, Applicants argue that Miyahara et al. teaches that volatilized hydrogen sulfide is recycled which would not satisfy this limitation. However, Miyahara et al. explicitly teaches that the hydrogen sulfide may be recycled to the apparatus **after** the dehydration step is completed, or at the polymerization step, or the volatilized hydrogen sulfide may be used in a later polymerization reaction (8:23-33). Further, Miyahara et al. exemplifies that the volatilized hydrogen sulfide is recycled to the reaction apparatus after the dehydration step (example 1a).

Applicants further argue that in the subsequent charging step (2), the amount of the charged sulfur source is calculated according to the newly added limitation "[charged sulfur source] = [total moles of sulfur charged] - [moles of sulfur volatilized our after dehydration]" requires that the discharged hydrogen sulfide is not recycled into the reaction system. However, Miyahara et al. explicitly teaches that the volatilized hydrogen sulfide may be recycled for a fresh polymerization reaction or other another polymerization batch (8:30-33). Further, the method for calculating the charged sulfur source is irrelevant when Miyahara et al. explicitly teaches that the total amount of sulfur falls within the claimed range of step two of instant claim 1.

Applicants argue that the claimed invention comprises four important process steps, which, in combination, provide a poly(arylene sulfide) (PAS) having the combination of

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improved physical properties as claimed. However, Miyahara et al. is believed to sufficiently teach the four claimed process steps of instant claim 1.

Applicants further argue that Miyahara et al. does not exemplify the claimed dehydration step wherein the alkali metal sulfide is prepared in situ by reaction of an alkali metal hydrosulfide and an alkali metal hydroxide. However, Miyahara et al. clearly and explicitly teaches that this step is possible. A reference may be relied upon for all that it teaches, including non-preferred embodiments.

Applicants further argue that in step (1) of instant claim 5 that at least a portion of the distillate is discharged from the interior of the system to the exterior of the system. Miyahara et al. explicitly teaches that water or the azeotropic mixture of water and the organic amide solvent is discharged **out of the system** along with hydrogen sulfide (7:44-48). While Miyahara et al. further teaches recovery and reuse of the hydrogen sulfide, Miyahara et al. exemplifies that the volatilized hydrogen sulfide is added after the dehydration step. Therefore, Applicants arguments on the top of page 11 are not persuasive. Specifically, Applicants argue that Miyahara et al. does not teach the claimed NaOH/NaSH ratio. However, Applicants are including the amount of additional NaOH added **after** the dehydration step. Therefore, Applicants arguments regarding this point are not found to be persuasive.

Regarding newly added claim 17, Miyahara et al. does not exemplify a poly(arylene)sulfide having a melt flow viscosity which falls within the claimed range. Specifically, examples 4a, 4b and example 5 are the only three exemplified poly(arylene)sulfides which satisfy the claimed melt viscosity. However, examples 4a and 4b employs a sodium hydroxide/sulfur source ratio of 1.75, which falls outside the range of instant claim 1. Example 5

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utilizes a solution of hydrogen sulfide which was previously adsorbed in NMP. Therefore, Miyahara et al. cannot be relied upon as an anticipatory reference regarding instant claim 17. However, Miyahara et al. is believed to render obvious this newly added claim, as described below.

***Claim Rejections - 35 USC § 102***

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 5, 7, 10-13 and 18 is rejected under 35 U.S.C. 102(b) as being anticipated by Miyahara et al. (US Pat. 5,840,830).

Claims 5 and 18: Miyahara et al. teaches a process for producing a poly(arylene sulfide) by polymerizing a sulfur source and a dihalo-aromatic compound in an organic amide solvent. Miyahara et al. first teaches a dehydration step whereby sodium sulfide and NMP are subjected to distillation, removing a part of the distillate containing water (10:55-67). While Miyahara et al. employs sodium sulfide pentahydrate as the starting material in the working examples, Miyahara et al. does explicitly teach that the sodium sulfide can be produced in situ by reaction of sodium hydrosulfide and sodium hydroxide (4:61-64) "in an almost equimolar amount" (6:49-53). The teaching "in an almost equimolar amount" would certainly suggest to a person having ordinary skill in the art to be within the claimed mol ratio of 0.95 to 1.02 of step (1) of instant claim 5. The reaction between sodium hydrosulfide and sodium hydroxide inherently produces water, therefore, the alkali metal hydrosulfide is present as an aqueous mixture with water as required by instant claim 5. Further, Miyahara et al. teaches that the alkali metal sulfide is

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generally used in the form of a hydrate or aqueous mixture. Since water is inherent to the dehydration step as taught by Miyahara et al., the limitation that the alkali metal sulfide is present as an aqueous mixture with water is inherently taught by Miyahara et al. Miyahara et al. therefore effectively anticipates the process limitations corresponding to dehydration step (1) of instant claim 5.

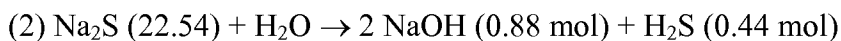
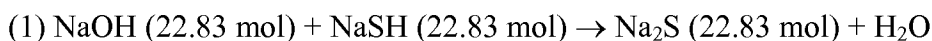
Miyahara et al. further teaches a charging step of adding sodium hydroxide and water to the mixture remaining after the dehydration step such that the mole ratio of water to charged sulfur source is from 0.3 to 5.0 (6:61-65) and the total number of moles of NaOH to charged sulfur source is 1.027. Arrival at the value is shown below:

Example of Miyahara et al. (12:34-51):



Total available "S" is  $(22.54 \text{ mol} - 0.50 \text{ mol}) = 22.39 \text{ mol}$

Since Miyahara et al. teaches that  $\text{Na}_2\text{S}$  can be prepared in situ from sodium hydroxide and sodium hydrosulfide (4:61-64) "in an almost equimolar amount" (6:49-53) Miyahara et al. teaches the following set of reactions when using an equimolar amount of NaOH and NaSH (the number of moles of each component is such that it equals the number of moles of  $\text{Na}_2\text{S}$  starting material used by Miyahara et al. in the application example):



Total available "S" is  $(22.83 \text{ mol} - 0.44 \text{ mol}) = 22.39 \text{ mol}$

Miyahara et al. further teaches that 7.9 g of NaOH (0.198 mol) is then added, providing for 22.57 mol of NaOH  $(22.39 + 0.198)$ . Additionally there are 0.88 mol of NaOH generated by

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volatilization of  $\text{H}_2\text{S}$ , thus yielding a total of 23.45 mol of NaOH ( $22.57 + 0.88$ ). The mol ratio of NaOH in the reactor/available S is thus  $(23.45/22.83) = 1.027$ , which falls in the claimed mole ratios of instant claim 5. Miyahara et al. therefore effectively anticipates the process limitations corresponding to charging step (2) of instant claim 5.

Miyahara et al. further teaches a first-stage polymerization step of adding a dihalo-aromatic compound to the mixture followed by polymerization at  $180\text{ }^\circ\text{C}$  to  $235\text{ }^\circ\text{C}$  to form a prepolymer at a conversion rate of 50-98 mol% (9:23-34). Miyahara et al. therefore effectively anticipates the process limitations corresponding to a first-stage polymerization step (3) of instant claim 5.

Miyahara et al. further teaches a second-stage polymerization step of controlling the amount of water such that there is from 2.0 up to 10 mol of water per mole of charged sulfur source with heating at  $245\text{ }^\circ\text{C}$  to  $290\text{ }^\circ\text{C}$  to continue polymerization (9:23-34). Miyahara et al. therefore effectively anticipates the process limitations corresponding to a second-stage polymerization step (4) of instant claim 5. In summary, Miyahara et al. anticipates all of the claimed process steps of instant claim 5.

The melt viscosity of the poly(arylene sulfides) taught by Miyahara et al. all fall within the claimed range of instant claim 5. While Miyahara et al. does not explicitly teach the other physical property limitations of instant claims 5 and 18, Miyahara et al. does explicitly teach all of the claimed process steps. Since the poly(arylene sulfide) as taught by Miyahara et al. and Applicant's disclosure are both produced in the same manner, any physical properties achieved by the compositions of Miyahara and the instant application would inherently be the same. A chemical composition and its properties are inseparable. Therefore, if the prior art teaches the

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identical chemical structure, the properties applicant discloses and/or claims are necessarily present. *In re Spada*, 911 F.2d 705, 709, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990). See also *In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977). "Where the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes, a *prima facie* case of either anticipation or obviousness has been established." See MPEP 2112.01.

Claim 7: Miyahara et al. further teaches during the dehydration step, that the reaction mixture is heated to a temperature of 60 to 280 °C (7:11-24).

Claim 10: Miyahara et al. does not explicitly teach that the prepolymer according to instant claim 5 has a melt viscosity during the first-stage polymerization step of 0.5 to 30 Pa·s. However, the poly(arylene sulfide) as taught by Miyahara et al. and Applicant's disclosure are both produced in the same manner, therefore any physical properties achieved by the compositions of Miyahara and the instant application would be inherently be the same. A chemical composition and its properties are inseparable. Therefore, if the prior art teaches the identical chemical structure, the properties applicant discloses and/or claims are necessarily present. *In re Spada*, 911 F.2d 705,709, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990). See also *In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977). "Where the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes, a *prima facie* case of either anticipation or obviousness has been established." See MPEP 2112.01



Claim 11 : Miyahara et al. further teaches after the second-stage polymerization step, (5) a separation step of separating the polymer from the reaction mixture containing the polymer, and (6) a washing step of washing the polymer thus separated with an organic solvent (9:49-64).

Claim 12: Miyahara et al. further teaches that the separation is achieved by sieving/filtering (9:49-64).

Claim 13: Miyahara et al. further teaches that the organic solvent used in the washing step is acetone (11:21-26).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Miyahara et al. (US Pat. 5,840,830) as applied to claim 5.

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Miyahara et al. teaches the process of instant claim 5, as described above. While Miyahara et al. does not exemplify a poly(arylene)sulfide having a melt viscosity which satisfies instant claim 7, it is believed that Miyahara et al. renders obvious this melt viscosity range. Specifically, Miyahara exemplifies polymerization at 220 °C for 4.5 hours, or polymerization at 220-260 degrees C for 1.5 hours (Table 1). However, Miyahara et al. teaches that both the polymerization times and temperatures may be longer than what is exemplified. Specifically, Miyahara et al. teaches a polymerization temperature of up to 350 °C, preferably up to 330 °C (8:65-66) and a polymerization time of up to 72 hours, preferably up to 48 hours. Increasing either the temperature of polymerization or polymerization time would be expected to increase the final melt viscosity of the poly(arylene)sulfide produced. It is submitted by the Examiner that either an increase in the polymerization temperature or an increase in the polymerization time would generate poly(arylene)sulfides of higher molecular weight, which would inherently display a higher melt viscosity. Therefore, it is believed that Miyahara et al. renders obvious the limitations of instant claim 17. It is well within the level of a person having ordinary skill in the art to carry out the polymerization reactions at various temperature and times as taught by Miyahara et al.

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

### *Correspondence*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ROBERT LOEWE whose telephone number is (571)270-3298. The examiner can normally be reached on Monday through Friday from 5:30 AM to 3:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Randy Gulakowski can be reached on (571) 272-1302. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR

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system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/R. L./

Examiner, Art Unit 1796

17-Aug-09

/Randy Gulakowski/

Supervisory Patent Examiner, Art Unit 1796